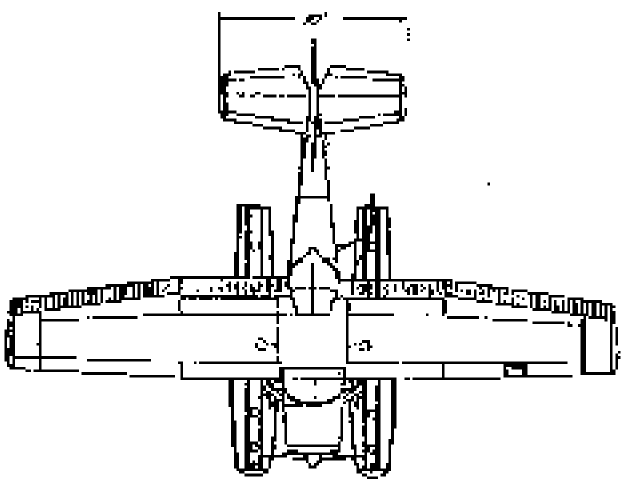
WaterWings
Seaplane School

Training Guide



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The Airplane

Introduction to the C150-150 Edo 1650-88 Floats

The Cessna 150 Floatplane you will be flying soon is a 1967 model 150G. It was originally powered by an O-200 Continental 4 cylinder engine producing 100 horsepower. It was upgraded to a 150 horsepower Lycoming O-320 engine to give it the extra power needed to make a really excellent float plane.

Difference between Land and Sea configurations

The plane was prepared at the factory to become a float plane. All the aluminum surfaces inside and out are coated with green zinc chromate paint to resist corrosion, and many reinforcements were added to beef up the airframe for the rigors of float flying.

You will also note that there are 4 lifting rings on top of the fuselage and a dorsal fin under the tail. The hooks are for lifting the plane to do float maintenance and repair. The dorsal fin restores positive yaw stability to the airplane making up for the large amount of float area forward of the center of lift. (More on that later.)

The last feature common to floatplanes is a longer and flatter pitch prop. This yields increased low end thrust and better acceleration and climb capability. It also means that in cruise flight the prop will overspeed if allowed to. Do not exceed 70 knots at full power. Max RPM should be 2700.

The floats are EDO 1650-88. This means that each float can float up to 1650lbs. To be legally certified, each float must displace or float at least 85% of the max gross weight of the airplane which gives a good degree of safety in case one or both floats are damaged.

Float Construction and Operation

Each float contains 5 water tight bulkheads, each with its own pump-out port. This again adds a degree of safety in case of damage, but primarily it keeps any water in the floats from shifting fore or aft in flight, which could easily throw the plane out of C.G. limits. Each compartment should be pumped out prior to the first flight of the day and after any significant number of landings or significant time on the water.

The floats are constructed of aluminum and thousands of rivets, and should be mostly watertight while not in motion; the pounding of landing and waves will force some water through the seams. Since the aluminum is thin the floats must be taken care of. Rocks, stumps, and logs will easily wreck a float, thus you should always be cognizant of your path and the waters around you.

The keel of the float is actually very strong and provides much of the rigidity of the float system. It is even possible to make a grass landing with the floats and do little if any damage. A hard runway landing is also possible in an emergency but I imagine the sound would be terrible.

You will soon come to realize how important the suspension of a land plane is. The float to airframe connection is extremely rigid. All forces are transferred from the floats to the airplane. This is the reason for the extra bracing and beefiness in the airframe. It will also teach you to avoid hard landings as the spine-airplane connection is also rather rigid.

Specifications

Gross Weight	1700
Rate of Climb	750 fpm
Service Ceiling	10700 ft
Take Off Run on Water	1310 ft
Take Off Run over 50 ft Obstacle	2075 ft
Landing Run	415 ft
Landing Run over 50ft Obstacle	850 ft
Fuel Capacity	38 gal
Oil Capacity	6-8 qts
Propeller	Fixed Pitch 80" Climb
Engine	Lycoming O-320
Wing span	32ft 8.5"
Length	24ft 1"
Height	9ft 1"
Vx-Best Angle of Climb	10° Flaps 60 mph
Vy-Best Rate of Climb	69 mph
Vne-Never Exceed	162 mph
Caution Range	120-162 mph
Maneuvering Speed	109 mph / 95kts
Flap Operating Speed	49-100 mph
Normal Operating Speed	56-120 mph
Final Approach Speed	60-70 kts

Weight and Balance

Airplane weight	1257 lbs empty
Max Gross Weight	1700lbs
Usual Fuel Load	20 gals at 6lb / Gal 120 lbs
Instructor Weight	190 lbs
Your Weight	??? lbs

Fuel Considerations

On Lake Martin fuel is relatively plentiful during the warmer months as the plane will operate fine on boat gas. Always be aware that people at marinas are not aware of the dangers of airplane propellers and they will not know your maneuvering challenges. They will try to grab onto all of your fragile control surfaces and yank to “help” you.

When planning a cross country you must consider lake drop-ins for fuel. In a higher performance seaplane where Avgas is required it would be wise to call ahead along your route to have fuel brought to you. Always allow time after refueling for debris and water to settle to the sumps. Marina gas can be iffy, so always drain the sumps and check for water and debris. Insist on doing the fueling yourself as gas dock personnel are not used to dealing with airplanes.

Landing Considerations

Landing Legally
When planning a trip you must consider whether the lake or stream that you plan to land on will accept airplanes. Many areas specifically restrict airplane use. The penalty for landing in a restricted lake can be severe.

Some places will not let you take off, meaning that your wings are coming off and the airplane will have to be trucked to another place. At best you may get a warning or a fine. Some places are restricted because the water is not conducive to seaplane activity due to currents or under water hazards. Others are restricted because of intense boat traffic. Still others are restricted because some other seaplane operator may have angered residents.

Whatever the reason it is important to know you are welcome. The Seaplane Pilots Association (SPA) publishes an annual seaplane landing directory which lists good and bad bodies of water and the people who control them. If in doubt you can contact the controlling authority.

Night Operations
In a straight (non amphibious) aircraft, these are emergency procedures at best. If caught in the air after dark or even near dark your safest move would probably be to head to a lighted airport and take your chances on the hard lighted runway, rather than risk ending up upside down and sinking in an airplane in the dark. It is nearly impossible to judge your height above the water at night. Everyone should walk away from the runway landing. The best idea is to not be in a straight seaplane after dark.

Boaters and Residents
Each lake is different but lake residents are often people who are trying to relax. They did not choose to live next to an airport. We must be careful not to draw their attention in a negative way. Try not to loiter in one area doing landing after landing-- spreading the joy is the best way not to offend anyone. It is also important not to continually fly low over the same areas. The nature of our sport is to fly low over the water and land on it. This is fine as long as no one feels annoyed or threatened.

Boaters have no clue as to how maneuverable we are. Sadly, on the water our airplanes make pretty poor boats. We cannot turn sharply and we cannot slow down terribly fast. Personal watercraft (Seadoos, Jet-Skis, etc.) are really fast and maneuverable with a tendency to change directions at random.

Boaters tend to focus mostly on what is in front of them. They will not see you and they probably cannot hear you. Avoid near contacts at all costs, and make sure your take off and landing path will remain clear for the duration of your procedure, and be ready to cut power on take off or go around on landing should the situation turn iffy. Always have an out.

Pre-Flight

As always, it is a good idea to check weather. Storms can develop very fast in our area turning the lake into a really inhospitable place to be, and the air even uglier. A check of the Weather Channel and a call to flight service is never a bad idea. You should also be sure that your flight will not run past sunset. A small headwind in a slow airplane can really make the trip longer than expected.

The Water
Next, a look at the water and the wind speed and direction will tell you which way the plane will blow when free of the beach or dock. Remember you have no brakes and the plane will begin moving immediately when free of its ties. The airplane will immediately weathervane into the wind and begin drifting backward until the engine starts.

There is also the possibility that the engine will not start, thus blowing you into whatever is in the path of the tail of the plane. Remember the front of the plane is reasonably well armored while the back end of the wings and tail are really fragile and expensive to fix. Your planning and contingency planning must start here.

The Airplane
Now that a successful unmooring and flight seem possible you can preflight the airplane. The preflight is similar to a land plane in most respects with the addition of the floats and the attachment gear. Your standard pattern around the plane may need to be amended as some parts of the plane may be hard to reach from the dock. Do not let this challenge cheat you of a thorough preflight.

Each float compartment must be pumped out. It is not necessary to get 100% of the water out, but pump until you are getting mostly air. If any particular compartment seems overly full you may want to consider further investigation before flight.

As you are going around the plane look at all of the external cables and pulleys. Look for chafing, fraying, and sticking. If the water rudder cables bind, the air rudder will bind as well. You will want rudder control on taxi, take off, and landing.Look for cracks and gashes in the float skins.

Pay particular attention to the pitot tube opening and the static ports. Bugs love to nest in these prefab condos. You will also want to take a good deep look into any engine compartment openings you can see into, looking for bird nests and the like—they will quickly catch fire when exposed to the heat of an aircraft engine that is being starved for cooling air by that very nest.

You may have to rotate the plane at the dock to get at all of the airframe to do your inspection. It is critical that all gust locks are removed prior to pushing off the dock. Lack of rudder control in a seaplane can be very traumatic as you drift / blow into what ever is out there. Remember brakes are not an option. Once you depart your mooring / dock you will be in motion.

When you push off from the dock you will want to get the plane started fairly soon. Realizing that you forgot the keys can be really frustrating as you blow towards the rocks backwards. A pre-push off checklist may be a good idea.

If you are taking passengers now may be a good time to do a thorough briefing, while they can move around the plane and see what you are talking about and they can hear you. It is easier to talk about prop safety while the machete isn't actively spinning. You might want to point out no-pull and no-push zones on the plane if your passengers are going to help with docking. This also gives passengers a chance to back out while you are talking about emergency exits and sinking airplanes. You should also use this opportunity to explain how the life jackets work and that they should not be inflated in the airplane.

Taxi

Once free of the confines of shore it is time to get the water rudders down and the engine started. This should be done before seat belts and head sets. You can use your preflight time to get all of those things ready, but once the plane is drifting it is more important to get forward motion, thus control, established. The lack of a seatbelt and headset may actually help if the engine won't start and you need to start paddling.

You will steer the airplane with your rudder pedals. Less power/speed = smaller turning radius in a seaplane, much as in slow flight. You can use one magneto and carb heat to further reduce RPM if need be for short periods of time (i.e. when approaching a dock). It is really important to keep engine RPM at or below 1000 while idle taxiing and to keep the stick/yoke all the way back.

This will minimize water damage to the prop by keeping the propeller from sucking water out of the lake and by keeping speed slow enough to keep spray from the floats under control. You should be mindful of aileron position if there is any kind of medium crosswind, and you should use the same positioning as you would a land plane.

You can use this taxi time to put on headsets and seatbelts and finish any leftover passenger briefing details. If the water is weed infested it may be prudent to pull the rudders up every few minutes to clear the weeds that may have collected. Directional control will suffer noticeably when the rudders are fouled with weeds. Do not be in such a rush to take off that the engine and oil don't get to warm up.

In a strong wind taxiing up or downwind will be easiest and safest. Seaplanes tend to be top heavy and tippy in a stiff breeze. While taxiing to your takeoff starting point you might want to complete your runup.

Water Run-Up

1. Stick Back

2. Mixture Rich

3. Area Ahead Clear (Nose will be high during run-up)

4. Engine to 1500 RPM

5. Mag Check

6. Carb Heat Check

7. Engine gauges and vacuum check

8. Back to Idle

9. Set DG to Magnetic Compass

10. Set Altimeter to 0 (Unless you will be landing in another lake) When you reach your take-off start point, cut power to idle, pull up the water rudders, and the plane will weather vane into the wind. If all has worked as planned you will be pointed towards lots of clear, deep, unobstructed water ahead.

Take-off

Normal Take Off: Into the wind of 3-9 Kts

1. Set Flaps to 10 degrees

2. Mixture Rich-unless at high density altitude (> 5000ft)

3. Fuel Pump On

4. Carb Heat Cold

5. Area Clear

6. Water Rudders Up

7. Stick all the way back

8. Full Power

9. Use significant Right Rudder to maintain straight path.

10. You will notice an initial rise with power added . There will be a pause of a few seconds, then there will be a second rise. When this rise stops, push forward on the yoke until you reach a more level attitude. If porpoising begins pull back some on the yoke. At this point you will have to adjust the amount of right rudder you are holding. Select a point on the nose and keep your path straight.

11. Adjust your pitch angle for least drag.

12. Allow the plane to fly off the water. 12a. If you are heavy or the density altitude is high, consider lifting a float out of the water.

13. Once the plane is out of the water it will accelerate briskly in ground effect. Keep it in ground effect until airspeed reaches Vx or Vy, being very careful not to let the plane settle back into the water.

14. You may make any turns necessary to avoid obstacles once airborne.

15. Maintain an airspeed that keeps the engine from over revving. Less than 70kts at full power should suffice.

Glassy Water TakeOff: Wind Calm to 3kts

Glassy water makes very high water drag. The wavelets that occur in a normal take off allow air to get under the floats reducing drag. In glassy water there is complete float contact and thus more drag. It may be advantageous to step taxi back and forth in your takeoff area to create some small waves on the water.

1. Since there is little or no wind you may take off in whatever direction gives the longest and safest run.

2. Begin the take off just like a normal take off.

3. Once on step use the ailerons to lift one pontoon slightly out of the water and use rudder to maintain your path, if you need to continue on straight, otherwise a slightly curved path will be okay.You should not raise the nose when you do this. It will slow you down.

4. Once you have the first float out of the water, acceleration will be brisk and flying speed will be achieved almost immediately.

5. Once free of the water you must maintain a positive rate of climb. A decent back in to the glassy surface could be very messy considering the high water drag. It is also nearly impossible to judge your height above the water.

Rough Water Take Off: 10+ Knots of wind.
Rough water is very tough on the plane, the floats, the prop, and your spine. The idea is to spend as little time on the water as possible and to keep the nose a little higher than normal to avoid the floats digging in and to keep the prop out of the spray.

1. Carefully get the airplane to the start of the take off run, being very mindful of your crosswind technique. Keep the throttle back to idle to avoid prop damage. Avoid step taxi.

2. Apply 20 degrees of flaps

3. The plane will quickly weathervane into the wind when the water rudders are retracted.

4. Begin takeoff as normal.

5. Once on step, keep a higher attitude than the normal take off.

6. The plane will fly off the water when it is ready.

7. If you bounce off of a wave hold your attitude. Do not try to dive for the surface or keep level with the water. Hitting the water nose up will be safe. Hitting the water nose down will not be safe.

8. Once positive rate of climb and a safe airspeed is achieved reduce flaps to 10 degrees or less, and continue climb.

9. If in doubt about your abilities to handle rough water, wait until it gets better. The water is usually calmer near sunsire or sunset.

10. During summer boating season areas of the lakes will be particularly rough and unpredictable. Boat wakes can be very painful and damaging to the plane and the pilot.

Crosswind Take-Off
Fortunately crosswind takeoffs are a rarity for seaplanes since lakes tend to be wide in many directions, and in narrow bodies of water and rivers there are usually trees or mountains blocking most of the breeze.

If you get into the situation where you must fly and there is a significant crosswind you must use the variable weathervaning tendency of seaplanes. More on this later, but essentially if the nose is low you will weathervane into the wind, and when the nose is high you will weathervane downwind.

Thus there is a point in between high and low nose attitude that the weathervaning tendency will equalize. As you might expect this is a finesse maneuver and will be covered late in your training. It is only covered here briefly to close out the take off section.

Flying Characteristics

Drag
A seaplane in the air will fly very similar to a land plane. The is much more drag involved and a bunch of extra weight, especially in amphibian aircraft. You will see this in cruise speed reductions of 10-20 knots. The floats actually provide some lift which is why most float equipped planes have an increase in max gross weight over the land plane versions of the same aircraft.

Yaw
You will notice that floatplanes have less yaw stability than a land plane. You will have to hold more rudder in a climb and coordination in turns will be a bit more touchy. Many seaplanes have an added dorsal fin to compensate for the lost yaw stability which is caused by the large amount of side surface area forward of the C.G.

Before Landing

Landing Area Selection
Chances are that all of your landings have been on official runways that have been designated by the FAA or some private individual who has actually made multiple successful landings. Every seaplane landing is unique. The area and the surface will never be exactly the same.

Unless you are landing at an official seaplane base that has defined water lanes (even these are not marked on the water) , you will have to learn to pick a suitable area, picture a runway, make up and fly a pattern, and maneuver the airplane down an untried final approach to an imagined landing spot. All of that may sound like a lot to conquer, but we will break it down into the components, and if you do enough seaplane landings you will feel confined when you have to land on a paved runway.

During and before World War II and the advent of hundreds of paved runways, most pilots were used to always landing into the wind on a field with no precisely defined and marked runways. Crosswind technique was far less important than soft field technique.

Reading the Water: Wind Direction and Speed

Since very few lakes have weather reporting capabilities and even the airports near lakes that have AWOS will report different conditions than the actual lake wind conditions, it is important to be able to read the water to determine wind direction and speed.

First of all, if the water is glassy and mirror like you have a low wind or calm condition and direction does not matter. Otherwise, you will notice that the water will appear glassy close to one shoreline, and against the opposite shoreline the water will be rougher. The wind will be coming from the glassy shore.

It takes 4-5 knots of wind to make this effect. If you have more than 7 knots of wind and a decently wide piece of lake, streaks will form on the water. The more wind the more pronounced this effect will be. These streaks will run precisely parallel to the wind. Combined with the glassy shore effect, you can determine direction.

Other easy indicators are dock flags and smoke to verify your water assessment. At 12-15 knots you may notice small white caps on the lake. Over 20 knots the white caps will be very prevalent and your landing will be quite rough.

Clearing the Area: Selecting Your Landing Spot
Knowing the wind conditions on the water you can now choose an area to land. You will want to find a spots that has the following characteristics.

1. Enough length. Seaplanes have a fairly short landing roll, and a somewhat longer take off roll. You want to be sure that you can get out of what ever you can get into.

2. Obstacle-free. Both your approach and your landing zone should be free of power lines, towers, islands, bridges, etc. Power lines can be particularly hard to spot. It is easier to see the poles. Narrow channels are a favorite spot to stretch the lines.

3. Boat and personal watercraft and swimmer-free. While you are surveying your spot, keep an eye on all the boat traffic. Boaters cannot generally hear you and they are not accustomed to looking in the sky for incoming aircraft. If the do notice you, they may try to get a closer look by cruising into your path or trying to race the airplane.

In any case, they rarely understand the limited maneuverability of airplanes during landing. Fortunately, you are generally faster than boats, and you have really good control in the air. Large boats make large wakes which are to be avoided. Personal watercraft such as Sea-Doos and Jet Skis are really fast and extremely maneuverable. They can and will change direction at random. Give them a wide clearance.

4. Wake-free. Large boat wakes are extremely hard on the plane and potentially dangerous. Encountering a wake head on will be painful. Encountering a wake parallel will create a really disconcerting side to side rocking motion.

Generally avoiding heavy boat traffic will help in wake avoidance, but occasionally a rogue wave from a far away boat may enter the area. Be vigilant and it may be necessary to extend your flare to fly over a big wave or just go around and wait for the wave to change. Boat traffic is cyclical. A spot may be really busy one minute and completely clear in 10 minutes.

5. Underwater Obstacle-free. A low pass over the proposed landing zone will help in determining the safety of your water runway. The seaplane does not need much depth but the float skins are very fragile and stuff just below the surface can ruin a float and your day. Be especially vigilant on rivers since the water may be very murky and the bottom can change rapidly. A submerged tree may have washed into what was a safe spot yesterday.

6. Finally, if your intention is to dock or beach somewhere, planning your landing to minimize taxi distance will limit overall wear and tear on the plane.

7. Compatibility. If multiple touch and goes are planned, and houses are present, try to move your practice area so as not to annoy any particular group of lake dwellers. Spread the joy. I also try to make my pattern over the less populated areas. Use right or left pattern to limit exposure to houses.

Once all characteristics are in place it is helpful to imagine the runway and the landing spot. This will simplify the pattern, the approach, and the landing.

The Seaplane Pattern
The seaplane traffic pattern is a rectangle like the land based traffic pattern only flown at 500 feet AGL instead of the typical 1000 feet, and the rectangle is smaller in width. The object of the seaplane pattern is to keep the plane within gliding distance of the water and to allow a better view of the landing zone. Use right traffic when safer and or more lake-friendly.

Downwind is the same as a land plane. Once abeam your landing poin,t reduce power, apply carburetor heat, mixture rich, fuel pump on, fuel on best tank, verify that wheels and water rudders are up. Add flaps.

At the 45° angle to the touch down point, turn base. Base leg is very short. It consists of a 90°+ (into the wind) turn, level the wings, check your approach path, begin your turn to final.

On final, normal landing power should be near idle, carburetor heat cold/off (in case a go around is needed), final check of the landing area, verify wheel position (up). In the 150 you must maintain at least 60 knots on approach, or flare will be impossible and a hard landing will follow.

Land the plane. Remember that this is a pattern of your own making. The FAA has not guaranteed any obstacle clearances and the residents of the area did not choose to live near an airport, so be mindful of towers, mountains, poles, and the neighbors.

Landing

Normal Landing
Okay. This is the really fun part. Your area is clear and you have a 7 knot breeze down the length of the lake. You're setup on final approach at 60 knots, 20° of flaps.

1. Flaps 20°. Any more in a 150 will make a go around more complicated

2. Mixture Rich

3. Water Rudders Up

4. Wheels Up if we had them (Not Applicable on the 150)

5. Carb Heat Off/Cold. In case of a go around. We used it on base leg to clear any potential ice.

6. Prop Control on High RPM. (Not applicable on the 150)

7. Area still clear.

8. 60 Knots

9. Power at or near idle.

10. Twenty feet above the surface begin a gradual flare.

11. Ten feet above the surface you should have a positive attitude. Nose slightly high.

12. Continue to bleed off airspeed and touch down just above stall. A slightly nose high attitude and slow (above stall) airspeed is critical to safety. A low nose will allow the floats to dig in possibly flipping the airplane. Too high a landing speed will cause excessive water drag on the floats, possibly flipping the airplane. A stall with too much height will cause the nose to drop and thus a nose low touch down, possibly flipping the airplane. We really want to avoid flipping the airplane.

13. Once on the water pull back on the yoke throughout the landing roll and set power to idle use rudders to keep the plane straight. If you feel porposing from the rear ease off on the yoke a bit. Under no circumstances let go of the yoke or press forward.

14. The airplane will come to a fairly quick idle taxi speed. You may then drop the water rudders and remove flaps. The yoke should remain full aft while taxiing.

Problem areas

1. Too high a pitch on touch down. An extremely high pitch on touchdown can cause the back of the floats to hit the surface first causing a nose down pitching moment

2. Airspeed (thus water speed) too high on landing. This will cause high water drag on landing thus a nose down pitching moment.

3. Stall before landing. This will cause a nose down pitching moment. 3a. Airspeed too low on approach. Anything below 60kts and the plane will not flare well, hitting the water hard.

4. Nose low on landing. Floats may dig in flipping the plane.

5. Too much power: this just uses up more lake.

Rough Water Landing

The object of a rough water landing is to keep the nose a little higher than standard to keep the prop well clear of spray and the float tips clear of digging into the waves.

The other primary goal is to keep landing speed as low as possible to limit the severity and duration of the waves pounding on the floats. This is most analogous to a soft field landing in a land plane. Set up for the rough water landing will be just like a normal landing with the following exceptions.

1. Flaps 30 degrees. This will add drag and help slow the plane once on the water

2. On flare carry a bit of power. This will compensate for the down pitching of the flaps and lower the overall stalling speed, and allow precise control of the touch down. Since there is probably more wind your landing roll should be short anyway so you can use more runway in the flare.

3. On touch down pull back on the yoke to maintain a nose high attitude.

Glassy Water Landing

While glassy water is picturesque and great for water skiing and a smooth boat ride, it can strike fear into even the more experienced seaplane pilots.

We as pilots are really used to seeing the ground rush by faster and faster as we get close to it on landing. There are multiple cues at an airport. The trees and runway get bigger, etc., as we approach a landing. On glassy water all of those cues are gone. We have a mirror to land on. There are multiple techniques that can be used to avoid the situation.

You can go to another area of the lake that may have some wind. You can land behind a boat that has stirred up the surface some, however be ever vigilant that you are faster than the boat and he may stop at any minute, thus give him lots of room and have an escape plan. You can land next to a reference, such as a bridge or trees along the shore.

Finally you can use the glassy water landing technique, which strives to avoid the double danger of hitting the water unexpectedly at a higher than normal touch down speed in a lower than normal attitude. The nature of glassy water is high drag anyway since there is high surface tension with no waves. This procedure MUST be followed precisely to avoid flipping the airplane.

1. Plan your approach to allow for a nice shallow final approach over a low shoreline which will be used as last height reference, followed by really long stretch of clear deep lake. In the 150, 20° of flaps should be used.

2. The object of the exercise is to be as low over the last visible reference point as practical in landing configuration, and at near minimum controllable airspeed, at a 100-150 ft/min decent rate. Once over this point your positive landing attitude should be set on the physical horizon and not changed. Power on the 150 should be set at 1900 rpm.

3. Continue your descent using power to control the rate of descent until you touch down. Do not feel for the surface. Do not look at the surface near you. Look at the horizon and manage your airspeed above stall. It is a good idea to practice this slow flight descent at altitude, to get the feel and to know the power settings and attitudes required.

4. Once you touch down which will be softly or hard as a rock depending on your descent rate, it is imperative to cut power and pull back on the yoke. Water drag will be a major factor.

5. Done properly this can be one of the best feeling landings possible in a seaplane.

Crosswind Landing
There may be occasions where the body of water doesn't allow an upwind landing. Assuming the crosswind is within the maximum demonstrated crosswind component of your airplane, the rare crosswind landing can be accomplished safely.

These usually occur on a narrow body of water so a rough water technique should not apply, and by the nature of there being a crosswind the glassy water landing should not be a factor. Your only worry is sideways movement on landing, or landing in a yaw. Float design assumes forward motion and thus are designed to track straight. A side load could tip our top heavy little airplane.

The answer is to land in a side slip into the wind. We will have a normal landing approach adding a side slip just enough to compensate for the wind and tracking straight down the runway. We will land on the upwind float and continue to compensate for the breeze with aileron and rudder.

Engine Out Landing
The good news is that seaplanes fare well on land or water in an engine out landing. There is significant structure under the plane and in front of the C.G. to keep the plane from flipping. The keel of the floats is rather strong and can stand some abuse. You would still rather put down on water than land

in most cases. The less good news is that the seaplane will not glide as far as a land plane.

Other things to consider:

1. Keep your airspeed up on final approach as this is your only tool to flare with. 60 knots in the 150.

2. Select a landing zone that will allow you to drift or sail to safety. Right in front of a dam may be a poor choice.

Night Landing
The best method here is avoidance. If you find yourself in flight after dark in a straight float seaplane (no wheels), and you don't have enough fuel to make it till dawn your safest bet would be to find a lighted grass strip.

Your next safest move is to find a lighted paved strip. Float damage should be minimal. Occupant damage should be none.

If you really know your landing area well, and you have a lighted final ground reference to use a glassy water landing is your only hope. Even on a highly moonlit night your height above the water will be impossible to judge.

Water Maneuvering

Center of Buoyancy: Managing weathervaning
Much of your on-the-water activities will involve the management of wind. As we have stated, the airplane in level attitude really wants to weathervane into the wind. Sometimes we need to travel downwind or crosswind. In calm 0-5 knots the water rudders will handle most of our needs. Airplanes with dual water rudders will be easier to manage than planes with only one rudder. Even then it is a good idea to keep your ailerons properly positioned to keep wind from getting under and lifting a wind. Gusts happen.

Water Handling

Plow Turn: Turning the plane downwind in a stiff breeze
Let's assume the situation is not ideal and we have a 15 knot breeze. We need to taxi to the other end of the lake for take-off The wind is too strong to get the airplane turned around to taxi downwind. As we mentioned earlier, the weathervaning tendency of the airplane can be reverse (tail into the wind) by shifting the center of buoyancy aft. This is done by applying power to raise the nose and using water rudder and ailerons to initiate a turn. Turns to the left will be easier (p-factor).

1. Water rudders down.

2. Yoke Full Aft. (As Always when taxiing)

3. Turn the airplane 15 degrees to the right with the rudders. Ailerons to the left to hold the left wing down in the wind. (We will use the initial weathervaning to get a turning moment the to the left)

4. Add Power (about 2000 rpm)

5. Initiate a turn to the left with full left rudder. The weathervaning tendency will reverse when the nose

comes up.

6. Neutralize ailerons when directly up wind and then reverse them. (Left)

7. When facing downwind go to idle and neutralize ailerons and rudder.

8. Now you need to very mindful of your rudder control. The airplane will continue to idle directly downwind, but stability is minimal. Any deviation will cause the the plane to want to weathervane into the wind.

If needed, you can use a plow taxi to straighten things up again. Extended plow taxi should be avoided due to high engine heating / low engine cooling and excessive prop spray. Step taxi should be avoided to in these severe conditions due to float pounding and over turn potential.

Realistically this is a rare maneuver. If the wind is that strong, the waves are going to be hard on the plane and there is a strong over turning danger.

Plow Taxi: Very stable; reverse weathervaning

Plow taxi is another rare maneuver, because it is really hard on the engine and prop. Speed is relatively slow, power is high, spray is plentiful, visibility over the nose is nonexistent.

1. Clear the area in front of you. You will not be able to see in this attitude.

2. Water Rudders down

3. Yoke all the way back.

4. Add enough power to get the nose high

5. Continue only as long as necessary (This is what you experience at the beginning of a take off run, before the nose goes over.)

Step Taxi & Turns: For calm water to get somewhere efficiently without lifting off.

Step Taxi is often used to get to the other end of the lake for take off. Speed will be decent, visibility okay, and engine cooling okay. Spray will be aft of the prop. Step taxi is essentially a take off run with the power reduced once on step (when the nose goes over and a level attitude is achieved).

In the 150 a power setting of 2000 rpm will generally be effective in keeping the plane on step without getting too much speed. Use the elevator to keep the attitude at minimum drag on the floats, just like on take off. The wings will be generating some lift and the plane will be rather unstable in turns. Use ailerons in turns to counteract the strong over turning tendency and keep turns really subtle. Never turn from downwind to up wind in a step taxi as over turning tendencies are strongest here.

If you see that you are going to hit a large wave, pull power immediately and pull back on the yoke to slow the plane. Step taxi is a calm water procedure. Water rudders should be up, there is plenty of air rudder authority, and the water rudders get a beating at that speed.

Sailing: Directing your drift; used in stronger winds to avoid dangerous turns to downwind

A seaplane actually makes a pretty good sail boat, except for the fact that you must sail backwards. There are several good reasons to sail a seaplane.

1. It avoids trying to turn downwind in a strong breeze.
2. No wear on the engine or prop.
3. Good directional control
4. Completely safe

To sail a seaplane, simply shut the engine down and retract the water rudders. The wind will blow you straight backwards. If you want to go right then point the tail of the plane right using left rudder and right aileron. The adverse yaw of the right aileron helps to turn the plane and keeps the upwind wing down. Reverse the procedure to go left.

Flaps are generally retracted, since they decrease airflow over the flight controls. Extending them will actually increase your water speed, but control suffers. Forward elevator may be necessary to keep the back end of the floats from digging into the water and causing a capsizing potential.

1. Shut down the engine.
2. Retract water rudders and flaps.
3. Yoke forward

Right
1. Ailerons Right
2. Rudder Left

Left
1. Ailerons Left
2. Rudder Right

Power On Sailing: Going sideways
You can also sail the plane with power on. This allows parallel parking in strong winds. In this case idle power is used to keep the plane's forward position constant. The rudder and aileron positions are opposite of power of sailing. Point the nose in the direction you wish to travel and cross control with ailerons. It is best to start sailing with the water rudders retracted then, once you get sideways motion, drop them to increase the yaw. Never taxi with more than 1000 RPM.

Post Flight Procedures

Docking: A thousand ways to hurt your airplane.

The vast majority of docks are designed for boats. They have lots of posts and reasonably good protection for hulls that have bumpers above the water line. Very few boat hulls extend outward below the water line. It is a good idea to know the dock you are approaching before committing. Many float planes have an elevator that extends beyond the width of the floats and they can be right at dock height. The 150 fits this description. Use common sense and scope out any potential hazards ahead of time. A straight in approach may be your only option, but that requires putting the prop where it can be most lethal or having a helper on the float, but the front of the floats is cushioned for that reason and there are no airplane parts that can be damaged in the approach.

General rules for approaching a dock:

1. Plan your approach to the dock up wind.

2. Kill the engine way before you get close to the dock. 20-30 feet away is a good place to kill the engine by pulling the mixture. You can slow your approach even before killing the engine by using carb heat and / or running on one magneto. It is far better to have to paddle to the dock than to crash into it.

3. Approach the dock at a 45 degree angle. This gives you a good angle and you can check out the dock before committing. You can also abort the docking procedure easier for a go around

4. When you are about 10 feet from the dock begin the turn to parallel it. Remember you have no brakes.

5. Never let a passenger get in front of the wing strut. Keep them away from the prop even if it is "Off"

Beaching
Always approach a beach at a 45°angle. Look for stumps and rocks. A sandy beach is the only kind of beach |to park a seaplane. The easiest way to beach a plane is to shut the engine down and pull the water rudders up and sail into the beach backwards. Never power onto a beach. Always leave yourself a way to abort the beaching. Another benefit to using a downwind beach is you know your seaplane will not blow off shore causing an embarrassing swim to recover your airplane.

Ramping
Some seaplane facilities may have a wooden ramp extending into the water. This is the one instance where some power may help in mooring your plane. Approach the ramp straight on at idle power. When the nose of the floats contact the ramp hold the yoke full back, retract the water rudders, and slowly add power to drive the plane up the ramp. When your position is good pull power to idle and secure the engine.

Other Topics

Rivers
Rivers are an awesome place to play. They can be 50 mile long runways.There are a few things to keep in mind.   The water in rivers can be more difficult to see through, so you have to be extra vigilant in your scan of a landing area. Rivers often carry logs and other troublesome objects in their current. If there is good flow you can often see waves or disturbances in the surface near a buried trouble or a shallow. I will generally do a low and slow pass over an area before I land on it, while watching out for wires and poles.

Landing in a river gives you the added feature of current. Should you land into the current or down current.   That is the question.   We have always been taught to land and take off into the wind, thus the popular answer among most pilots is into the current. All this is assuming a no wind condition. If you land into the current, you will be increasing the water speed that you will be touching down on, thus increasing the drag when you hit. This is generally undesirable. Landing down current will reduce your water speed and drag. Optimally the wind will be in your face going down current. You will have to judge which is the greater evil when the wind is blowing downstream. Rivers and current also have the problem of moving objects along.   Be sure to moor or tie your plane well, such that it will be there when you return.

High Density Altitude
Density altitude is something that most of us who live in the lower altitudes rarely worry about. My home airport lies at 700 feet above sea level. Lake Martin is 500 feet above sea level. During the summer months, however, that 500 feet MSL can turn into a 3,000 foot density altitude, and this is what the plane is trying to fly in.

Density altitude increases as temperature rises. The engine has less dense air to breathe, coupled with a wet, humid air mixture, which further reduces the burnable oxygen in the air. Our wings and propellers are also suffering from the lack of air to work with. So the wings must be moving faster through the thinner air to generate the necessary lift, and this translates to an increased ground speed for take off.

This should not be a problem with a really long runway if the engine can accelerate the plane to take off airspeed. The added drag of the wheels going faster is negligible, and since the air is thinner, the drag on the airframe is not really an issue either. It just takes a long runway.

So what make seaplanes different? The water. Water drag increases at the square of speed. This means that there is a speed at which the water drag will cause the plane to cease acceleration. If this point is below the speed that allows the plane to fly, then we just don't get to fly. You will also see this phenomena in boats. Many boats with small motors can get to 25-30 mph. It takes a much bigger engine to get to 60mph. Very few boats with ridiculously large engines can get over 100.

So what can be done about this situation? We can fly earlier in the morning or later into the evening when the temperature cools. The evening plan is not so good for a non-amphibious seaplane due to the impending darkness. We can also utilize the wind or a current to get us moving a little faster. Sometimes creating some waves by taxiing around a bit can help get us off the water by reducing the drag. Be wary of your oil temperature during long step taxi maneuvers.

We can also reduce weight. I once got stuck on a river in an amphibious Scout. We tried everything we could to get airborne, but it was just too hot and too calm to get going. Eventually I left the airplane and got a ride to a nearby paved runway where my friend, who could now get airborne without my 190lbs holding him down, could pick me up. We had no trouble taking off from the paved runway.

U.S. Coast Guard Boating Rules & Regulations:

http://www.outdooralabama.com/boating/

Boating Safety Course:

Online Boating Safety Course http://www.boat-ed.com/al/course/index.htm

Sound Signals http://www.boat-ed.com/al/course/p3-4_soundsignals.htm

Buoy System http://www.boat-ed.com/al/course/p3-7a_buoysystem.